Practical proportional models and limitations

6 questions | 14 marks

Equivalent correct methods earn the corresponding marks.

1. A constant-rate model uses 3 L of cleaner for 24 m². State the rate in L/m². [2 marks]

$3/24 = 0.125$ L/m².

Answer: 0.125 L/m²

2. Use that model to predict cleaner for 60 m². [2 marks]

$60 \times 0.125 = 7.5$ L.

Answer: 7.5 L

3. State two conditions needed before applying that cleaner model to another room. [2 marks]

The rate may change with surface, dilution, number of applications or wastage.

Answer: For example: same surface type and same cleaning method/strength.

4. A prediction is 7.5 L. Cleaner comes only in 4 L containers. How many are needed? [2 marks]

$7.5/4 = 1.875$ containers.

Round up to 2; they supply 8 L.

Answer: 2 containers

5. A machine produces 30 items in 2 minutes and 75 in 5 minutes. Does a proportional model fit? Find its rule. [3 marks]

Both rates equal 15 items/min.

The rule gives zero output at zero production time, assuming no startup loss.

Answer: $N = 15t$, with t in minutes.

6. The same machine needs 3 minutes to warm up before producing items. Explain why total items are not directly proportional to time measured from switch-on. [3 marks]

During the first 3 minutes, output is zero.

After warm-up, $N = 15(t - 3)$ for $t \geq 3$; this is not $N = kt$ from switch-on.

Answer: The warm-up period introduces a delay.